“State of the U.S. Energy System: Importance of Geothermal and Waste Heat Power”

Southern Methodist University
March 14, 2013
Dallas, TX

By: Jon Wellinghoff

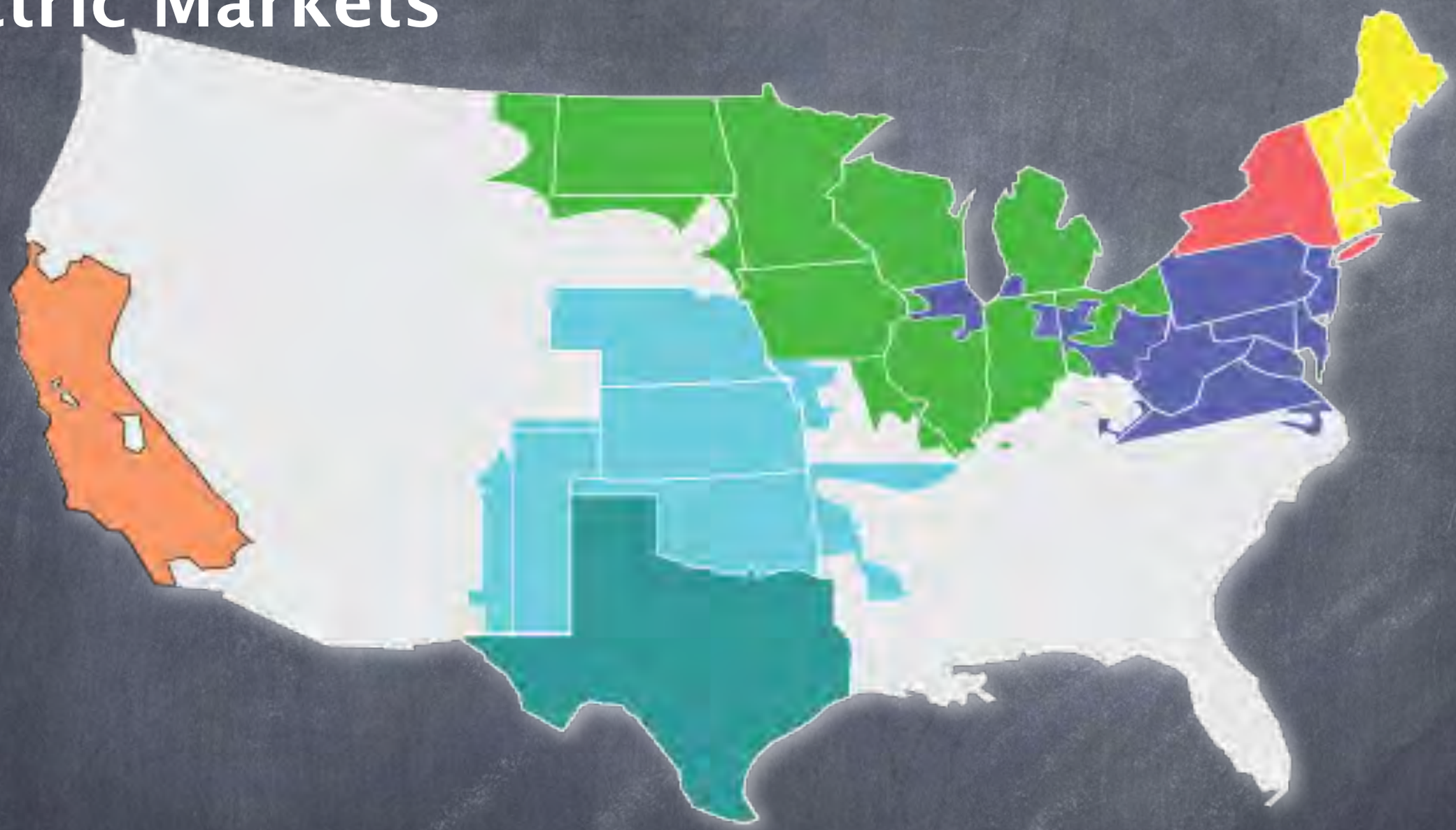
Geothermal

Source: Wikipedia

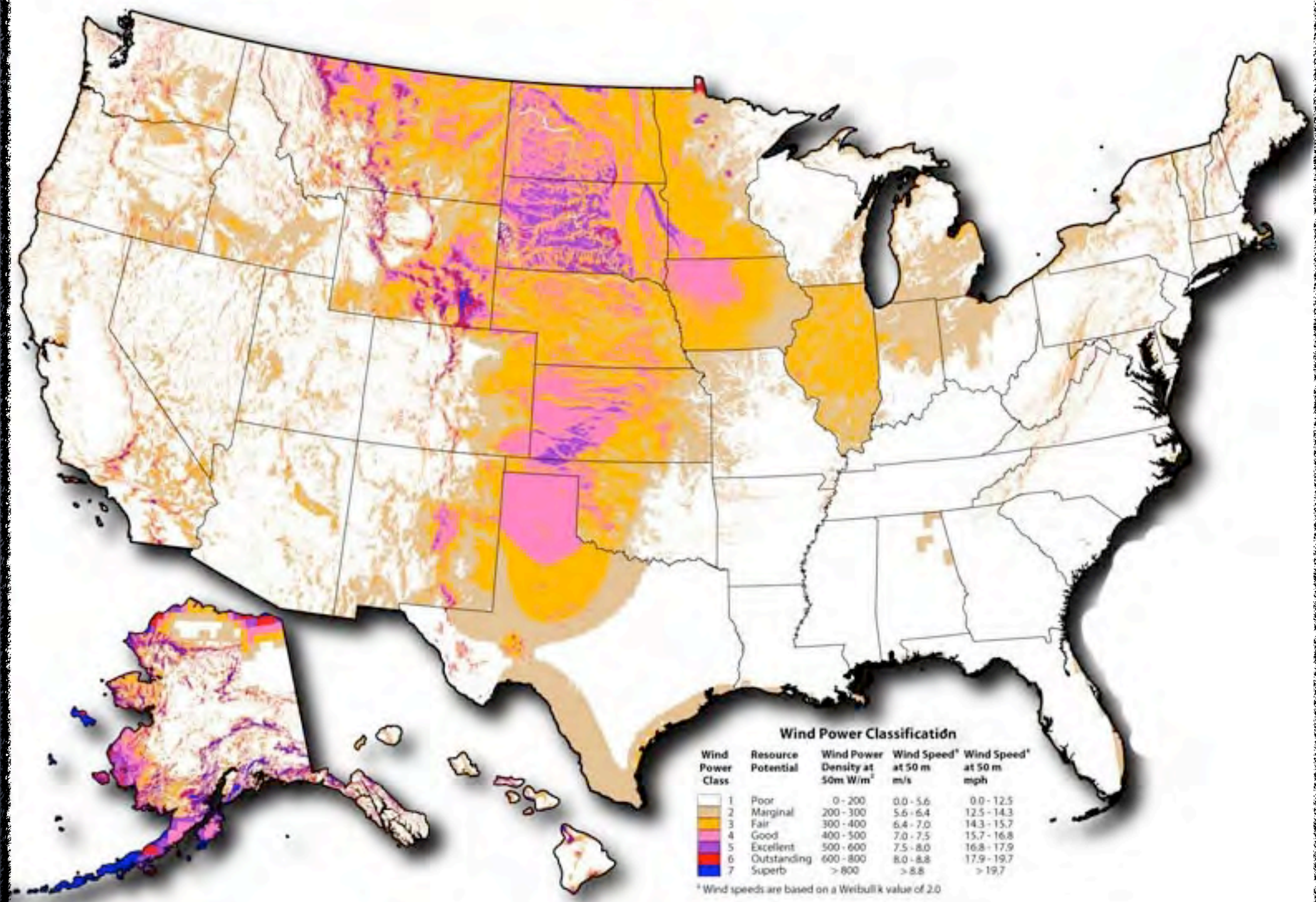
Source: EnergyBoom.com

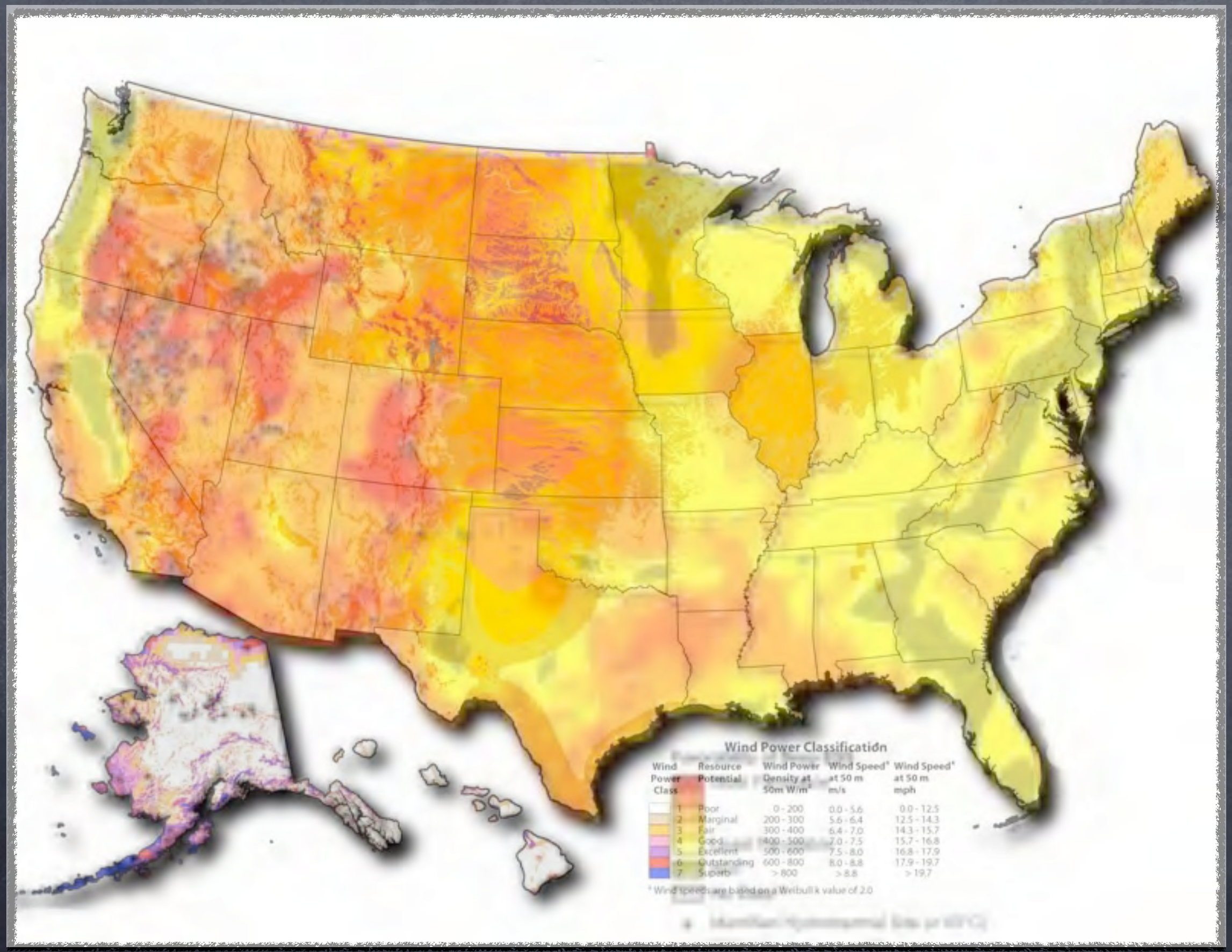
Geothermal Systems

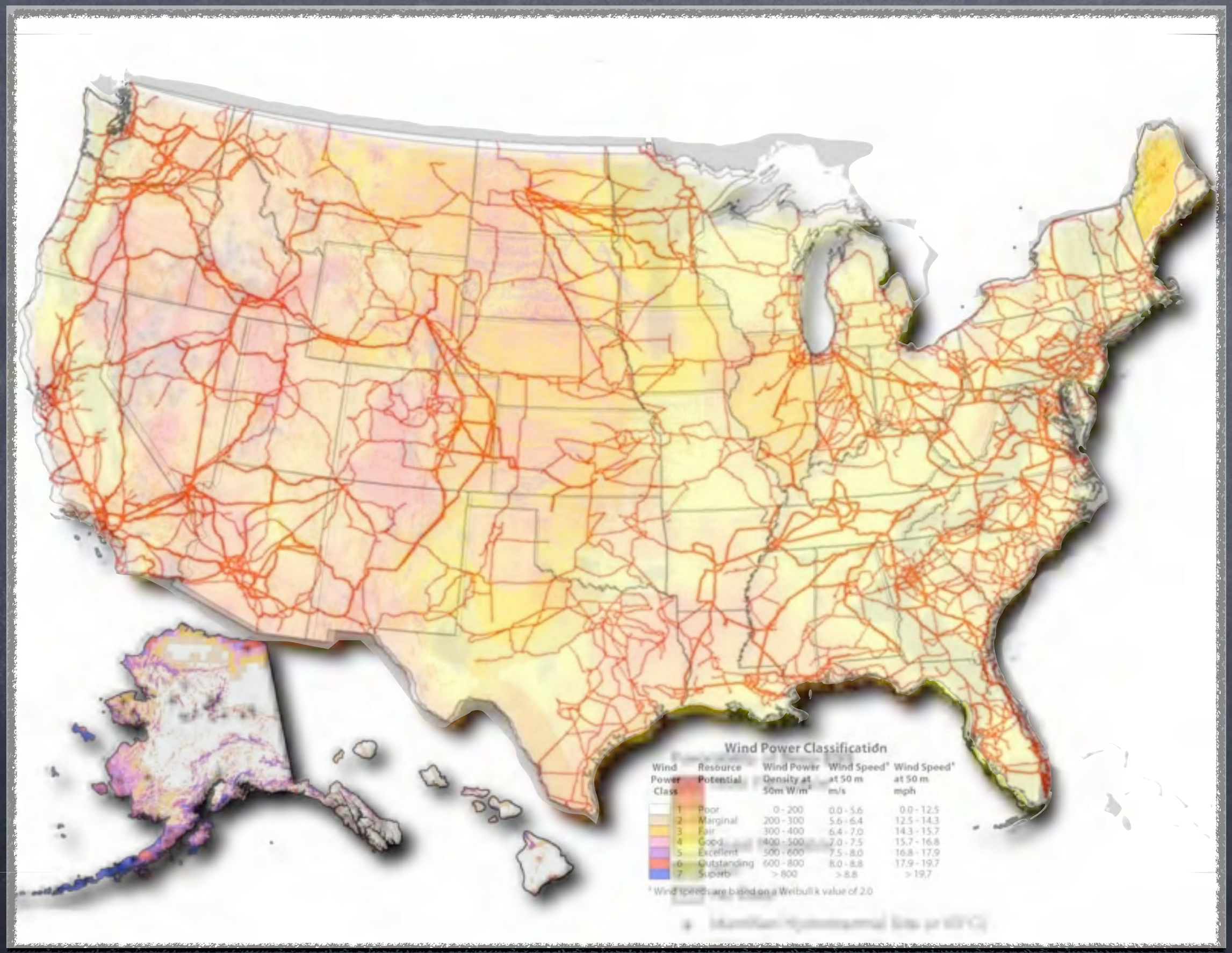
FERC Independent Organized Wholesale Electric Markets



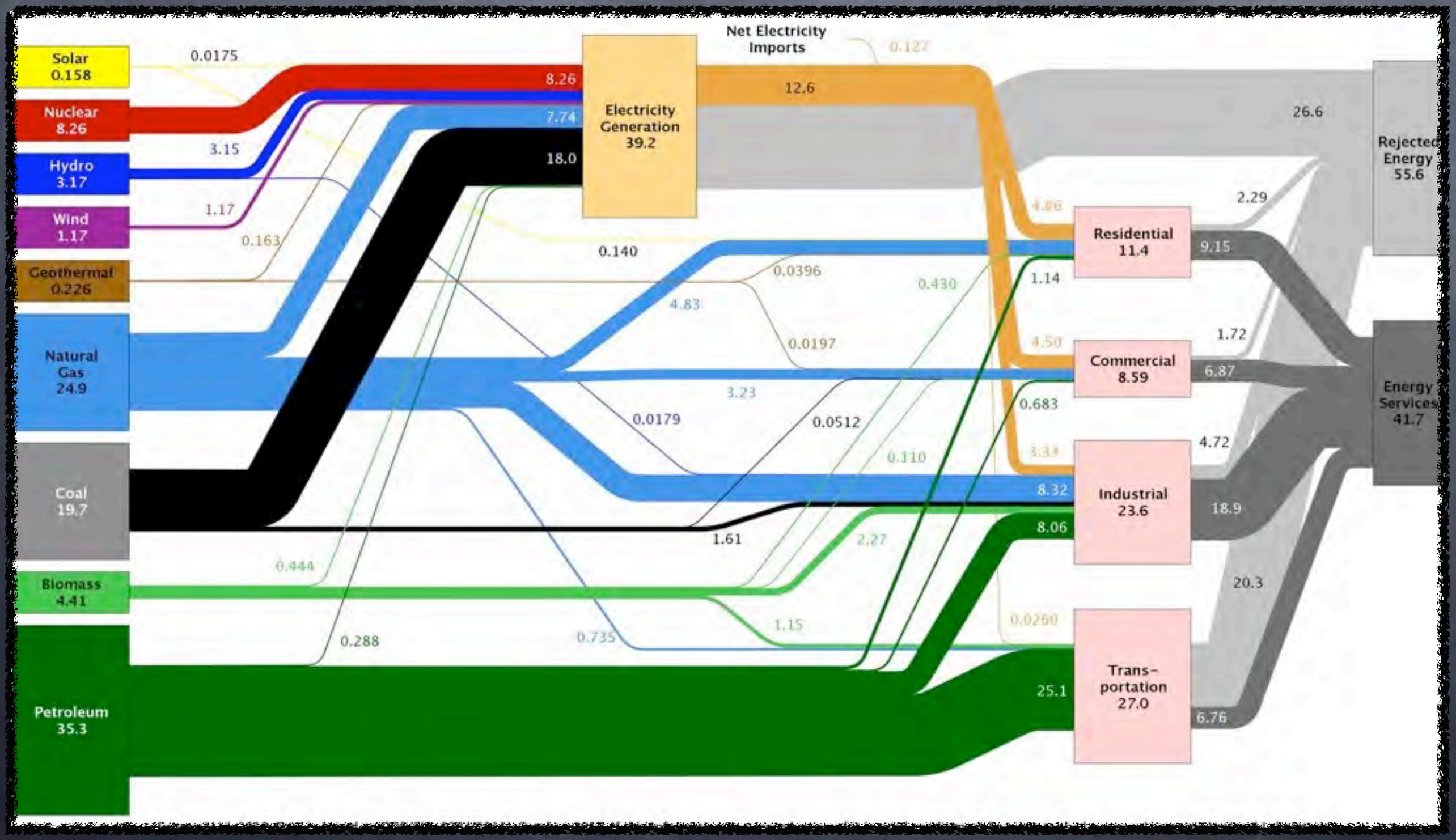
- Midwest ISO
- PJM Interconnection
- California ISO
- New York ISO
- ISO New England
- Southwest Power Pool
- Electric Reliablity Council of Texas


Wind Power Classification
Wind Power Class
Resource Potential
Wind Power Density at 50m W/m²
Wind Speed* at 50 m m/s
Wind Speed* at 50 m mph
1 Poor 0 - 200 0.0 - 5.6 0.0 - 12.5
2 Marginal 200 - 300 5.6 - 6.4 12.5 - 14.3
3 Fair 300 - 400 6.4 - 7.0 14.3 - 15.7
4 Good 400 - 500 7.0 - 7.5 15.7 - 16.8
5 Excellent 500 - 600 7.5 - 8.0 16.8 - 17.9
6 Outstanding 600 - 800 8.0 - 8.8 17.9 - 19.7
7 Superb > 800 > 8.8 > 19.7
* Wind speeds are based on a Weibull k value of 2.0

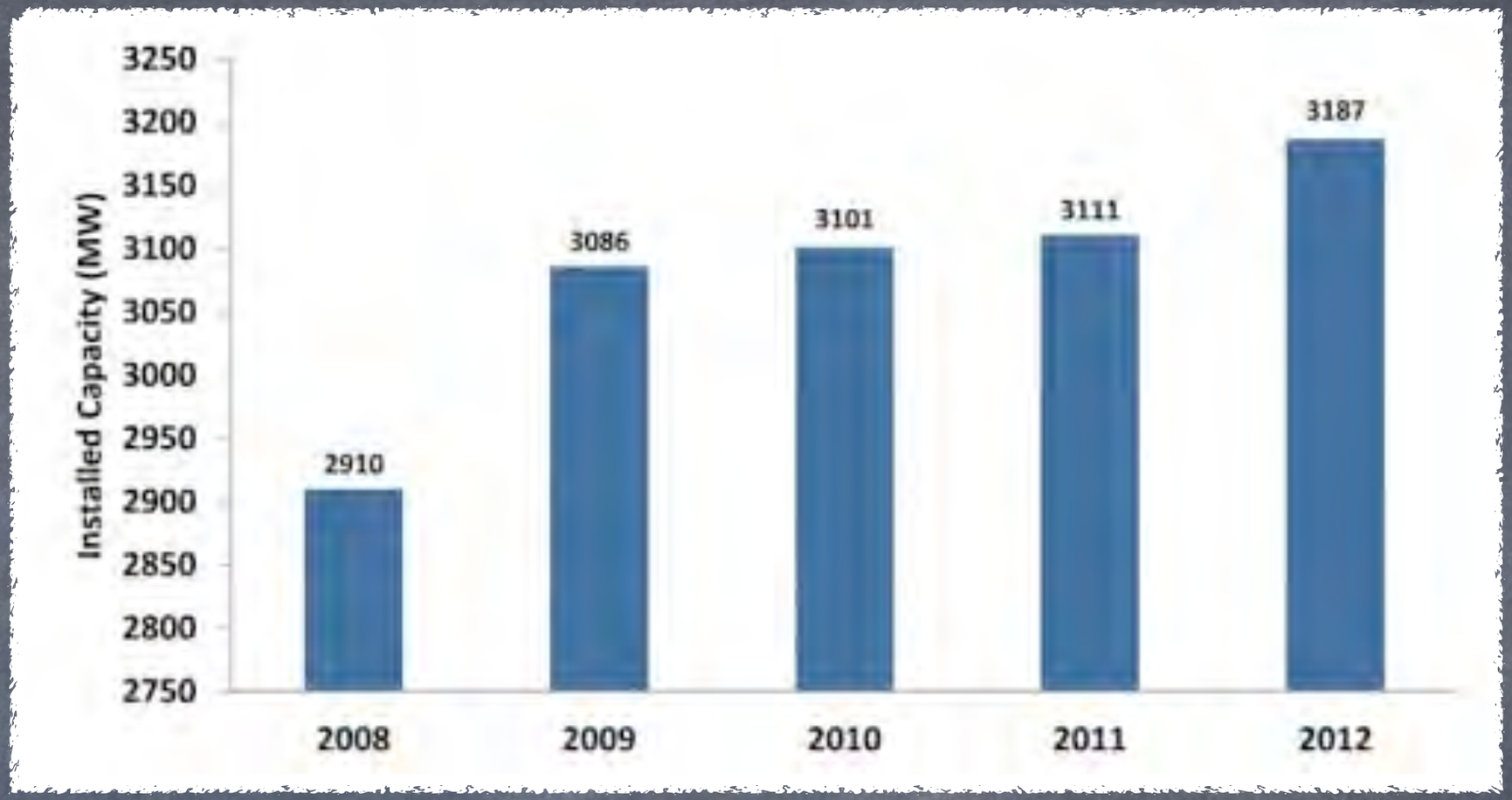

Wind Power Classification
Wind Power Class
Resource Potential
Wind Power Density at 50m W/m²
Wind Speed* at 50 m m/s
Wind Speed* at 50 m mph
1 Poor 0 - 200 0.0 - 5.6 0.0 - 12.5
2 Marginal 200 - 300 5.6 - 6.4 12.5 - 14.3
3 Fair 300 - 400 6.4 - 7.0 14.3 - 15.7
4 Good 400 - 500 7.0 - 7.5 15.7 - 16.8
5 Excellent 500 - 600 7.5 - 8.0 16.8 - 17.9
6 Outstanding 600 - 800 8.0 - 8.8 17.9 - 19.7
7 Superb > 800 > 8.8 > 19.7
* Wind speeds are based on a Weibull k value of 2.0


Wind Power Classification
Wind Power Class
Resource Potential
Wind Power Density at 50m W/m²
Wind Speed* at 50 m m/s
Wind Speed* at 50 m mph
1 Poor 0 - 200 0.0 - 5.6 0.0 - 12.5
2 Marginal 200 - 300 5.6 - 6.4 12.5 - 14.3
3 Fair 300 - 400 6.4 - 7.0 14.3 - 15.7
4 Good 400 - 500 7.0 - 7.5 15.7 - 16.8
5 Excellent 500 - 600 7.5 - 8.0 16.8 - 17.9
6 Outstanding 600 - 800 8.0 - 8.8 17.9 - 19.7
7 Superb > 800 > 8.8 > 19.7
* Wind speeds are based on a Weibull k value of 2.0

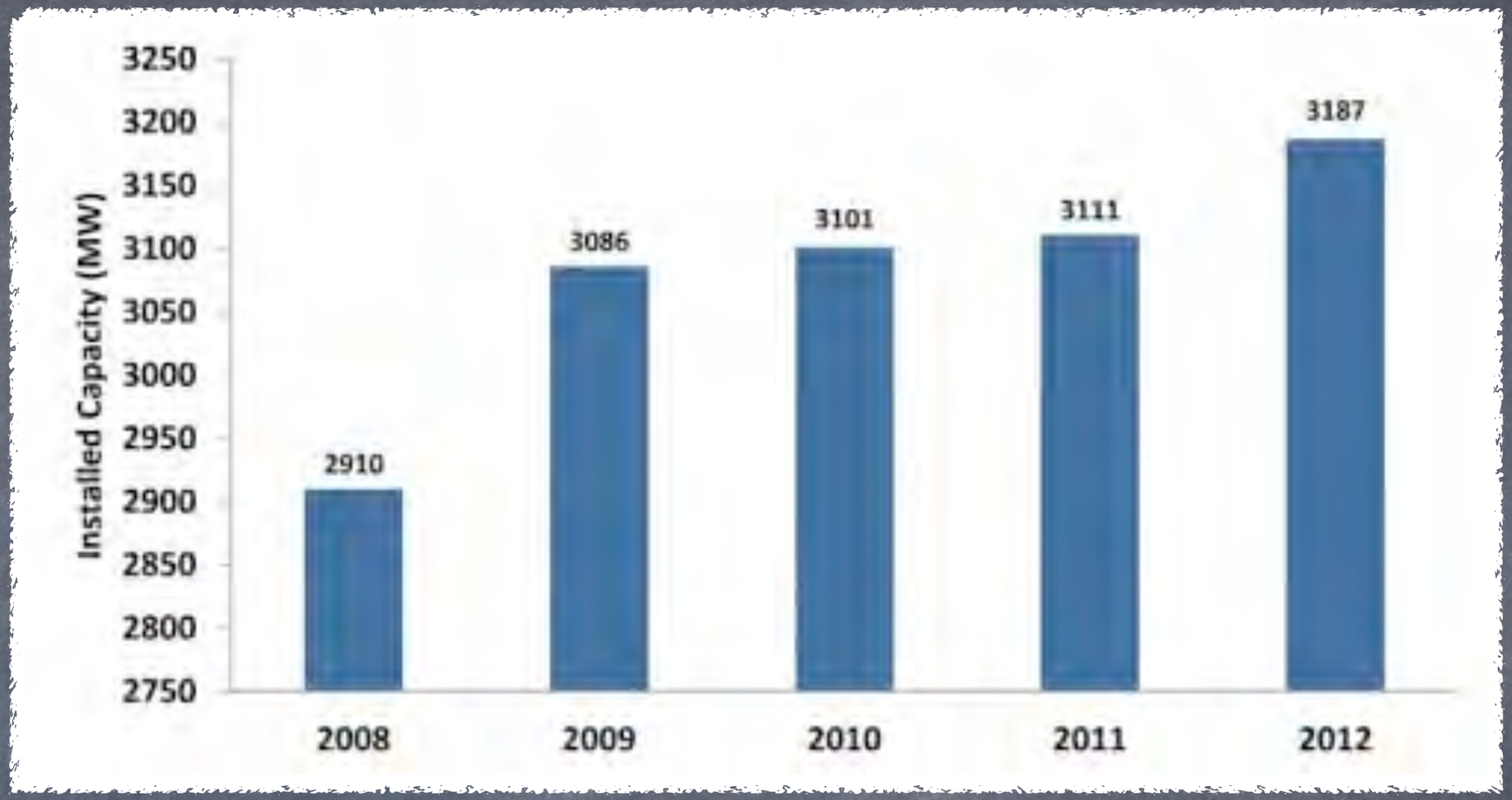
Estimated U.S. Energy Use 2011- ~97.3 Quads



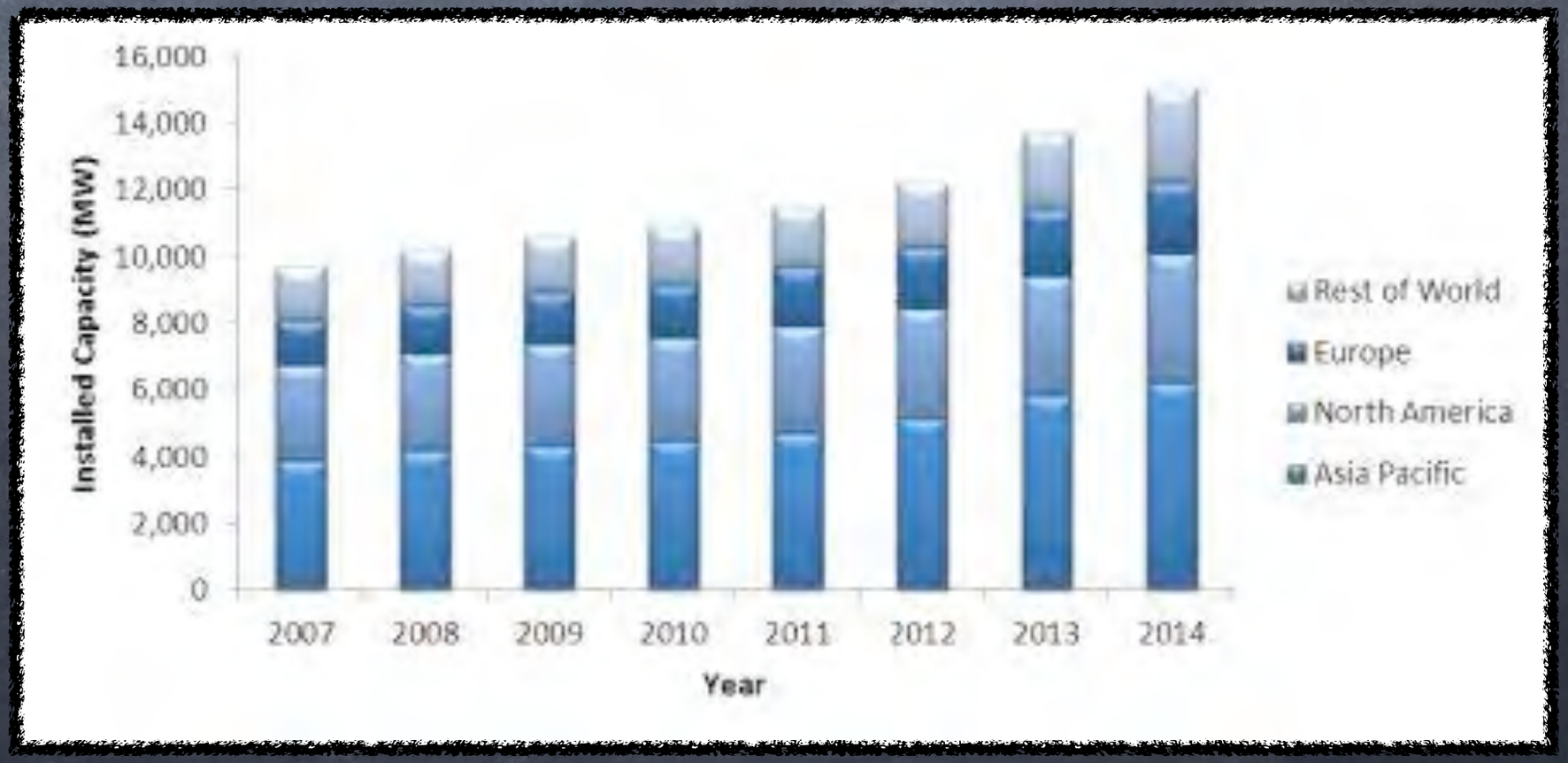
Installed Geothermal Capacity (u.s.)



Installed Geothermal Capacity (u.s.)

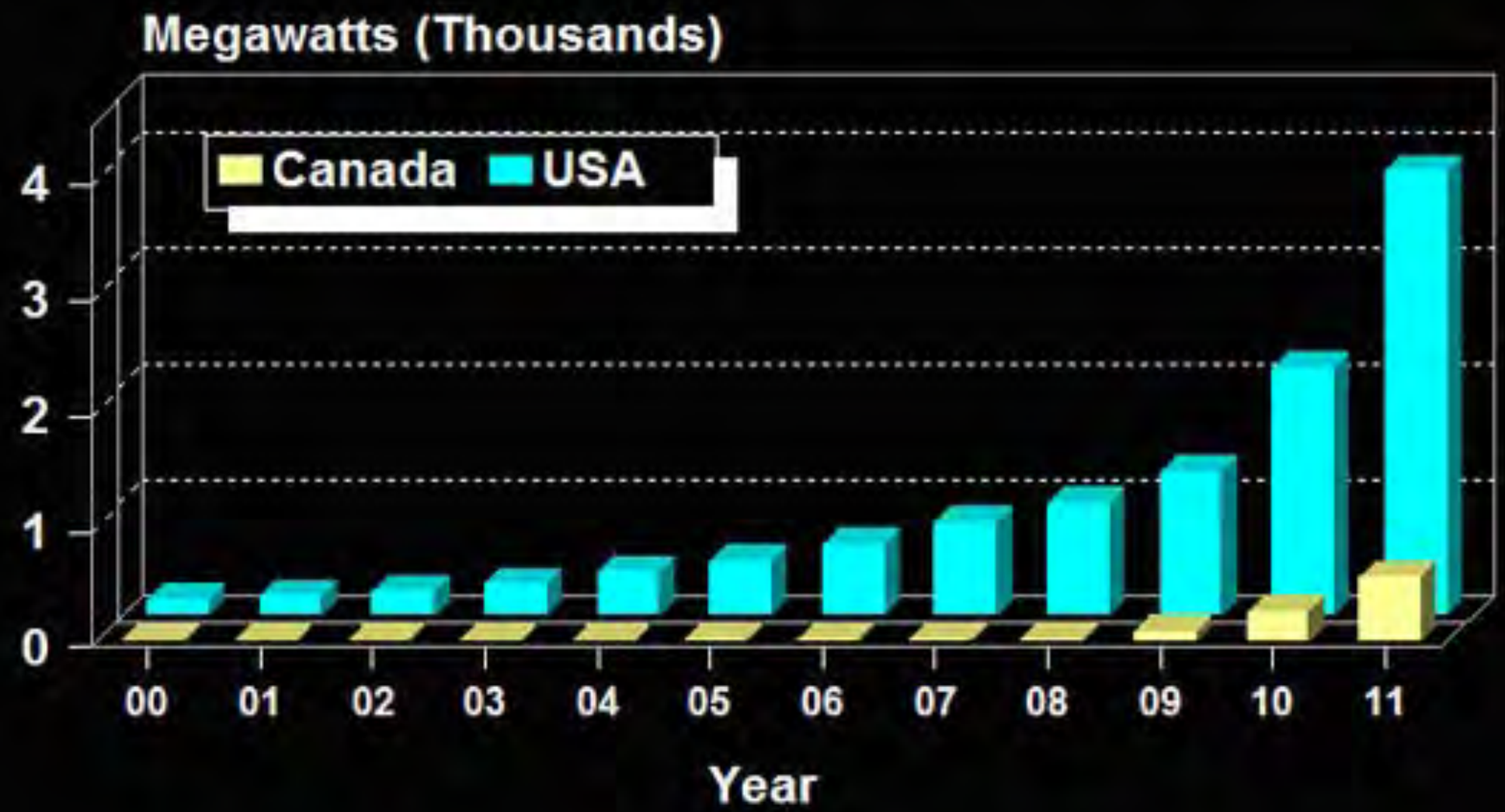


Installed Geothermal Capacity (Global)



Source: SunPowerCorp.com First Phase of 250 MW California Valley Solar Ranch Energized

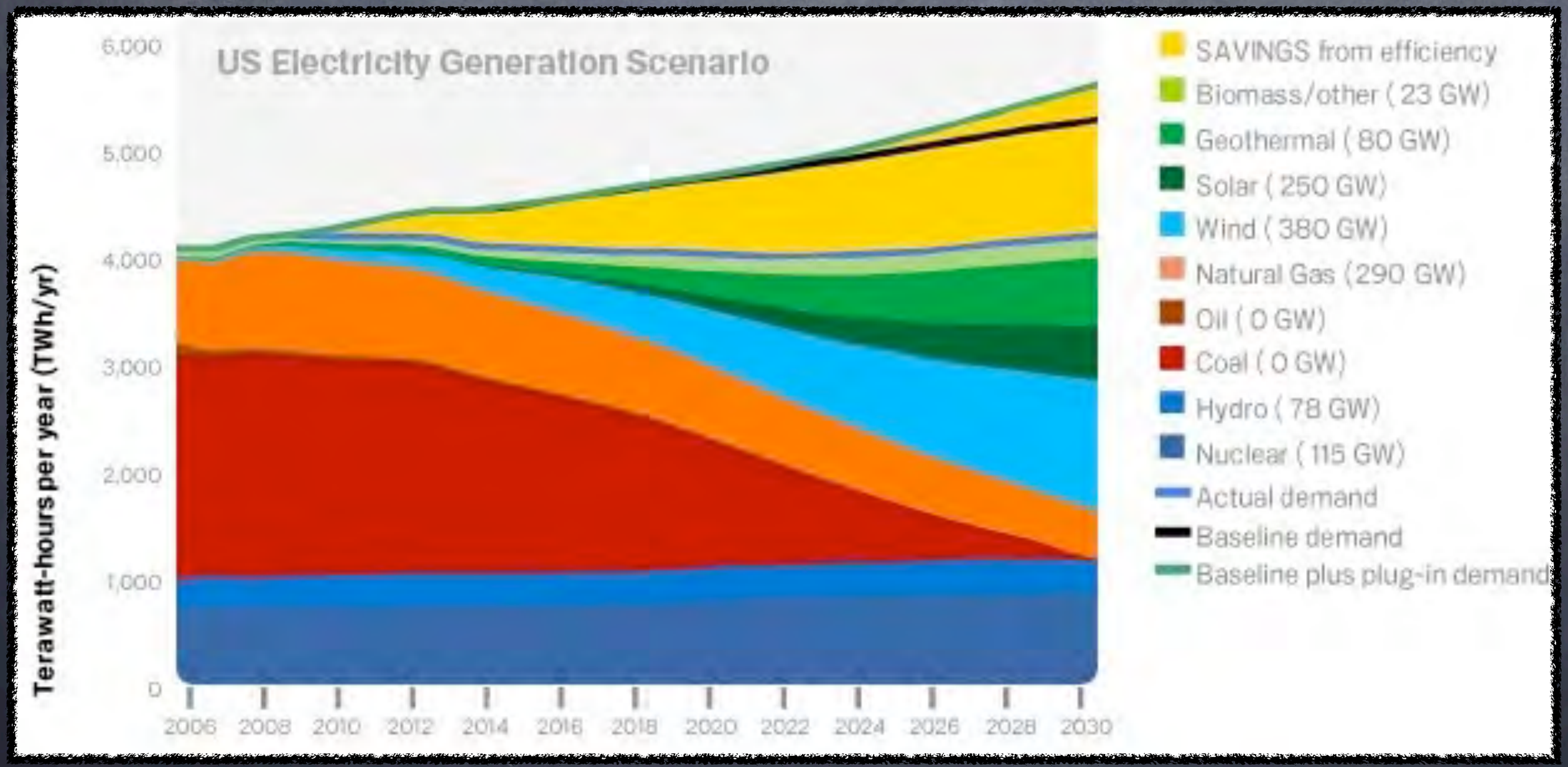
Solar PV Development in North America



Paul Gipe, wind-works.org

Source: SunPowerCorp.com First Phase of 250 MW California Valley Solar Ranch Energized

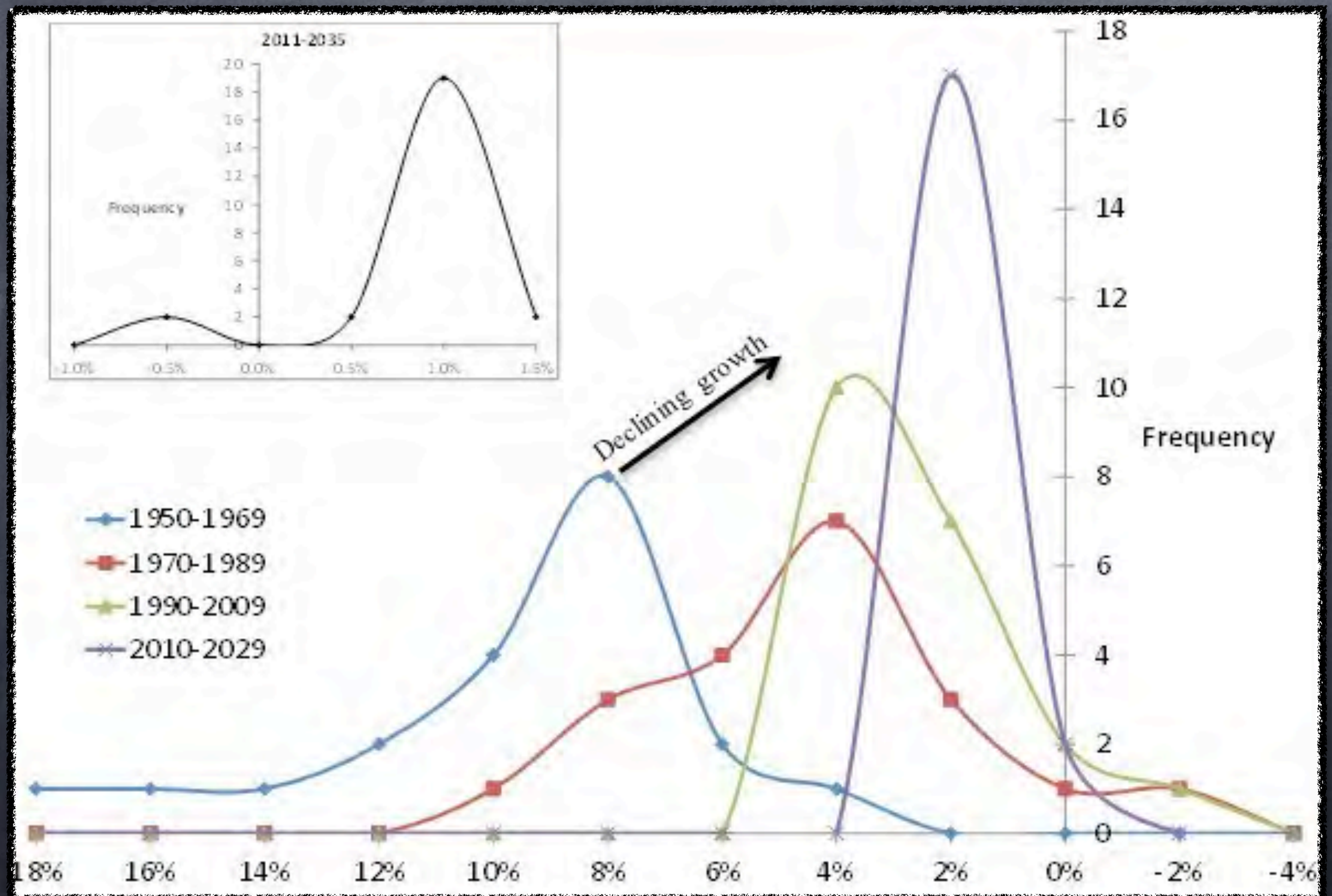
Google Electric Future



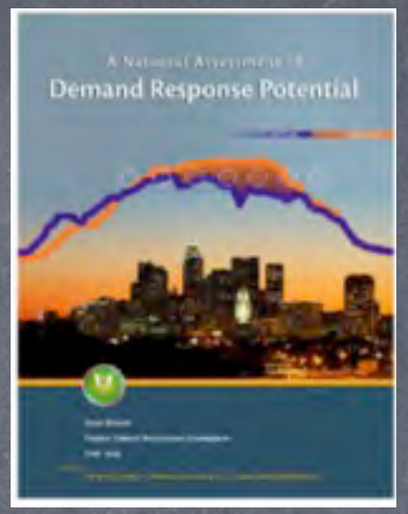
States with Geothermal Power Production in 2011*

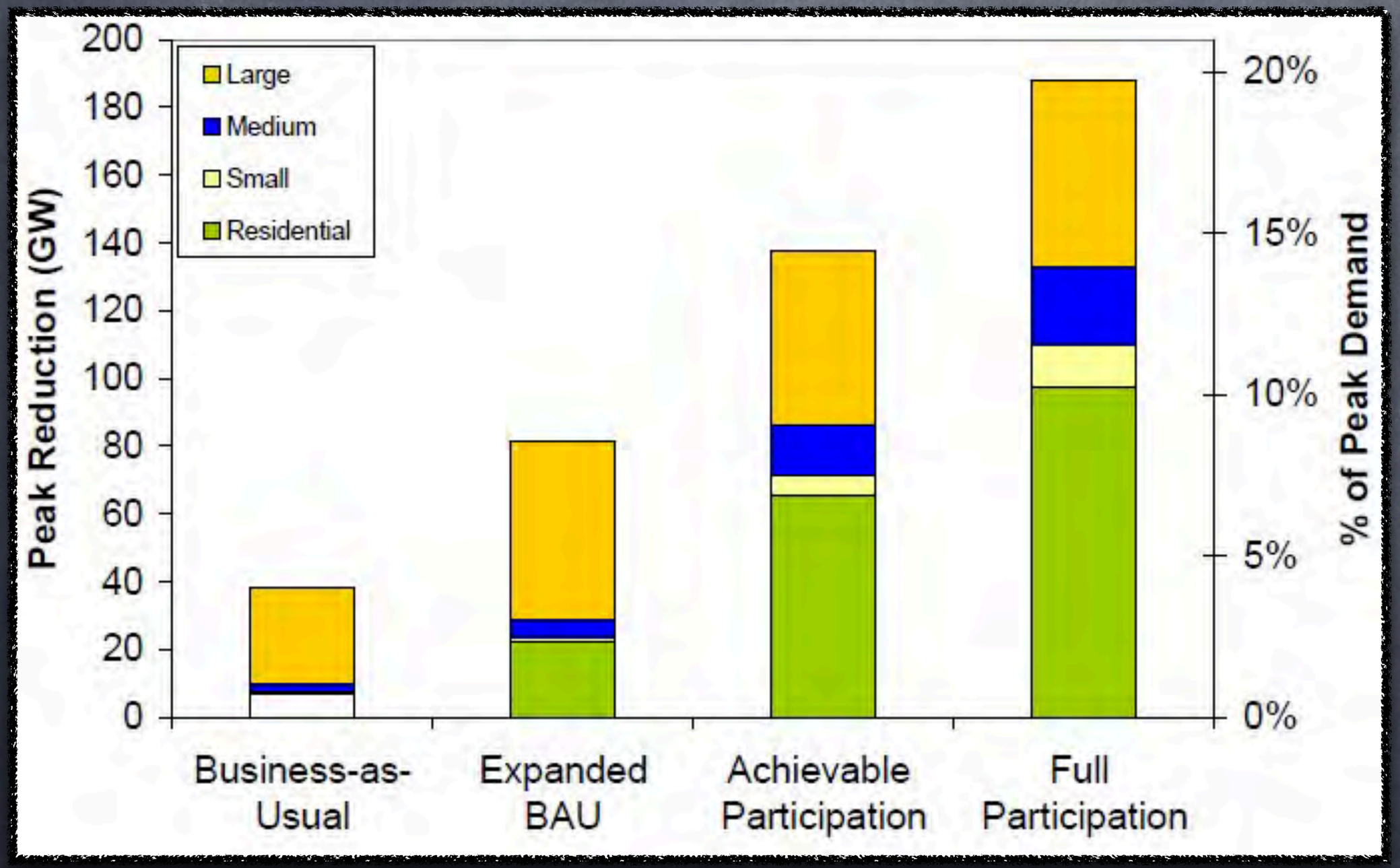
States with Geothermal Capacity in Development in 2011

Distribution of Electric Load Growth



FERC Assessment of DR Potential – at 2020





Rapid Expansion of Distributed Generation

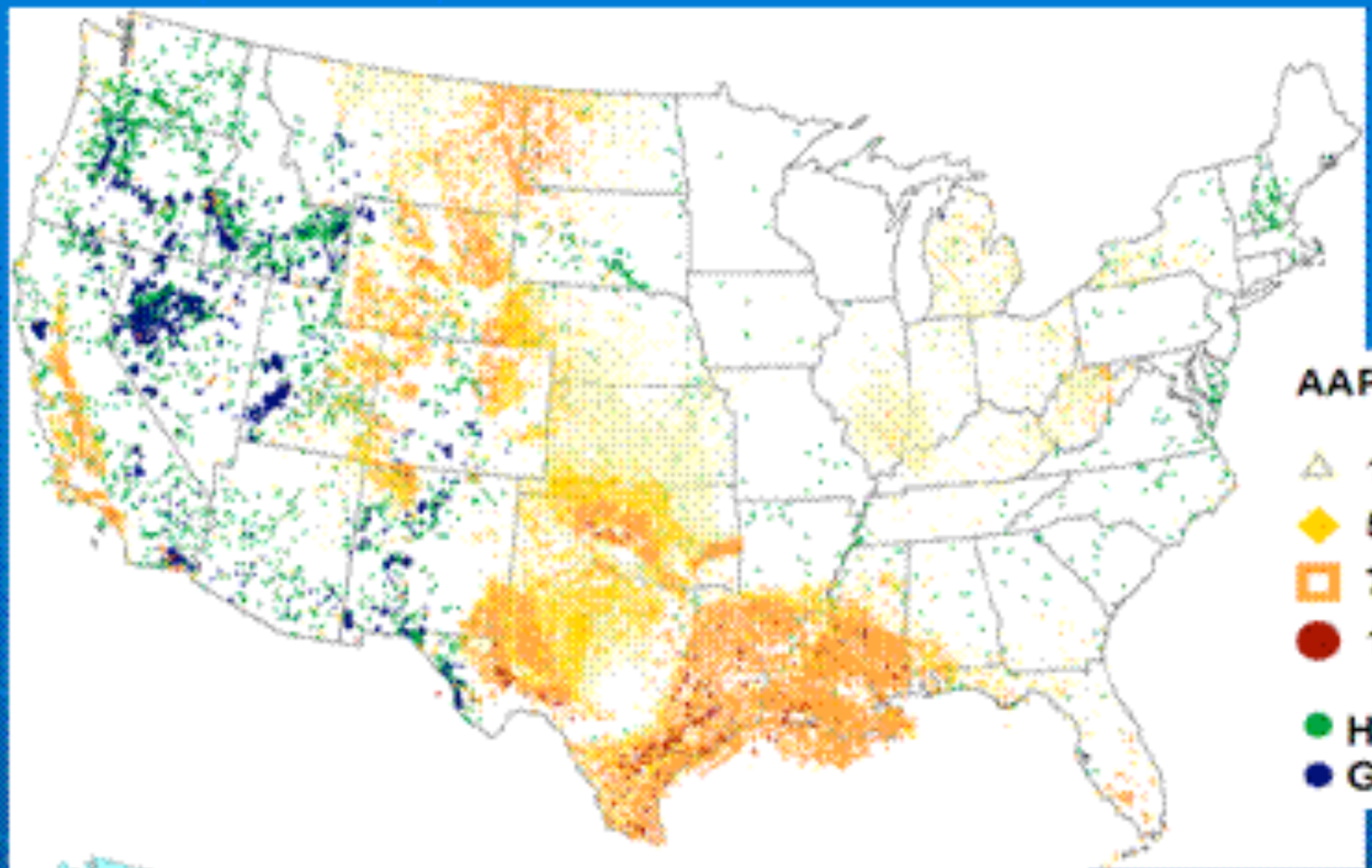
Rapid Expansion of Distributed Generation

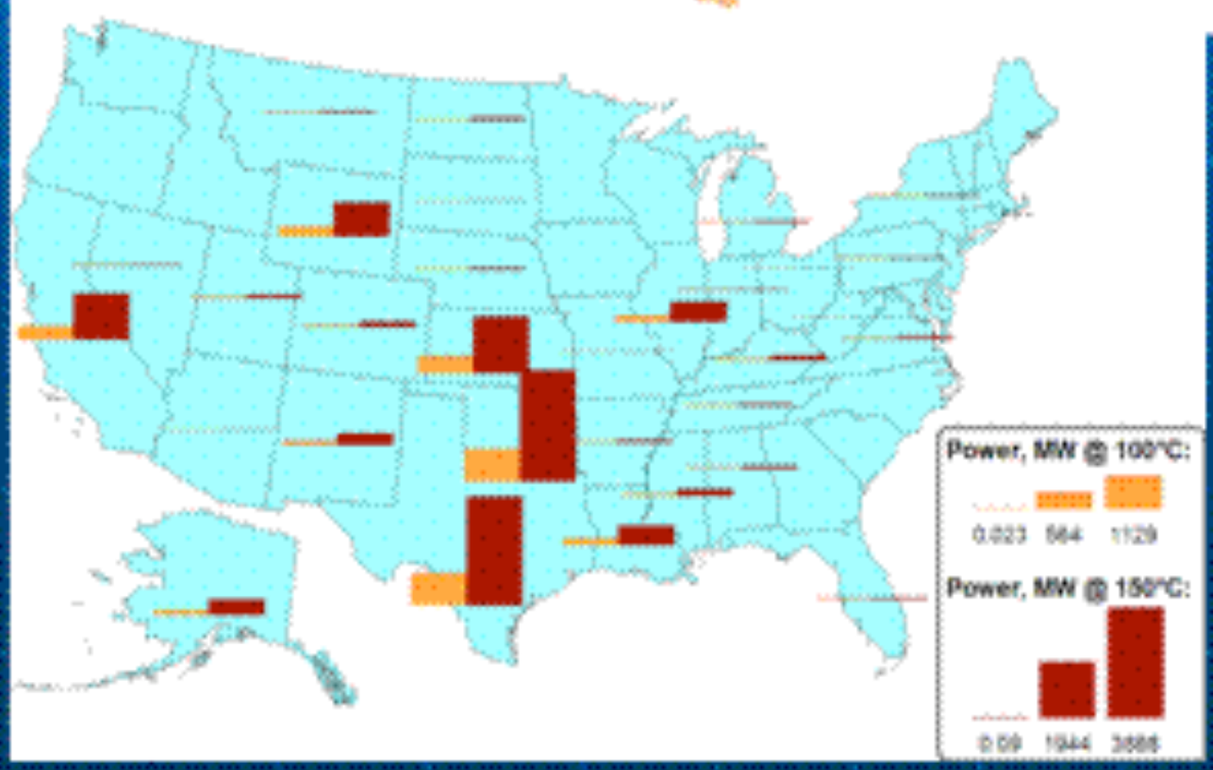
Rapid Expansion of Distributed Generation

Rapid Expansion of Distributed Generation

Distributed Geothermal

Co-produced Geothermal Energy Potential (Blackwell, SMU)





State	Total Processed Water, 2004 (bbl)	Power, MW @ 100°C	Power, MW @ 140°C	Power, MW @ 180°C
Alabama	203,223,404	18	47	88
Arkansas	258,095,372	23	59	112
California	5,080,065,058	462	1169	2205
Florida	160,412,148	15	37	70
Louisiana	2,136,572,640	194	492	928
Mississippi	592,517,602	54	136	257
Oklahoma	12,423,264,300	1129	2860	5393
Texas	12,097,990,120	1099	2785	5252
Totals	**32,952,140,644**	**2,994**	**7,585**	**14,305**